

## **THE DEPARTMENT OF ENERGY'S ENVIRONMENTAL MONITORING PROGRAM**

### **Conducted by the Lawrence Livermore National Laboratory**

The Department of Energy (DOE) and its predecessor agencies has conducted detailed environmental and agricultural studies that have been carried out for many years by the Lawrence Livermore National Laboratory (LLNL). These have been done to determine the radiological conditions at four atolls in the northern portion of the Marshall Islands. Doses have been estimated for the populations most affected by the fallout from the atmospheric nuclear weapons test in the 1950's in the Marshall Islands. Rongelap and Utirik were contaminated on March 1, 1954 by a U.S. nuclear test at Bikini Atoll code named BRAVO. The 67 Pacific detonations were conducted at Bikini and Enewetak Atolls.

The contribution of each exposure pathway and radionuclide have been evaluated. Dose assessments show that the major potential contribution to the estimated dose is cesium-137 uptake via the terrestrial food chain. Cesium-137 in the terrestrial food chain accounts for about 90% of the dose at the atolls surveyed by LLNL. These studies also show that the radionuclides remaining today that contribute in any significant way to the estimated dose of cesium-137 are (cesium-137, strontium-90, plutonium 239+240, and americium 241).

Environmental and dietary models have been developed utilizing as input residual levels of contaminants in samples of soil, vegetation (food crops and natural species), marine species, animals, fowl, and ground and cistern water. Soil samples are dried and with the use of gamma spectroscopy are analyzed for their activity level. Radiochemistry is conducted to determine the amount of plutonium 239+240 and its potential contribution to dose. Quality assurance is provided through multiple intercalibration exercises every year with the International Atomic Energy Agency (IAEA), the National Institutes of Standards and Technology, and other organizations throughout the world. The IAEA intercalibration exercises cross-calibrate the LLNL analytical results with other participating laboratories around the world.

Mitigation technologies, such as the use of non-radioactive potassium fertilizer have been developed that can effectively reduce the uptake of cesium-137 by foods and plants that prefer the potassium if they have the choice. This helps to reduce the uptake of cesium-137 in local food supplies. In addition, studies are on-going on the environmental half-life of cesium-137 and other radionuclides in the soils and water sources which effectively reduce environmental dose due to gradual natural disappearance of the radionuclides from atoll soils and water tables.

Resettlement of the atolls in order to live at "home" is very important to many of the Marshall Islands people. Decisions are facilitated by those wishing to resettle by providing dose estimates from the environmental methods. These realistic dose assessments help to ensure that people are not excluded a priori from going home because of unrealistic, over-conservative dose calculations. In the Marshall Islands, this translates into realistic diet models for estimating the intake of local foods because of the importance of cesium-137 uptake in terrestrial foods that subsequently provide the majority of the estimated dose.